Sex Differences in Depression, Dyspnea, and Cognitive Functioning Among Patients with Chronic Lung Disease

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Abstract

Chronic obstructive pulmonary disease (COPD) and idiopathic pulmonary fibrosis (IPF) account for more than 200,000 American deaths each year, and are debilitating and costly conditions. Dyspnea, the subjective symptom of breathlessness, is the most common physical symptom among lung disease patients. These patients are also likely to experience depressive symptoms as well as cognitive impairment. Although the rate of chronic lung disease incidence is similar in men and women, relatively few studies have examined sex differences in psychological functioning of patients with pulmonary disease, and no prior study has explored sex differences in both COPD and IPF patients. Therefore, this study utilized archival data to investigate sex differences in the relationship between psychological and cognitive functioning among men (n = 21) and women (n = 10) diagnosed with COPD or IPF. At a routine clinic visit, participants completed self-report measures of distress and tests of cognitive and pulmonary function. Pearson correlations evaluated relationships among measures of cognitive function, psychological well-being, and pulmonary functioning. Analysis of variance evaluated sex differences on all outcome measures. Results indicated no sex difference in levels of depression or dyspnea; and depression was more highly correlated with dyspnea in men than in women. In a subgroup of participants matched on ventilatory impairment, women demonstrated better cognitive performance than men, but among both men and women, better quality of life was associated with enhanced cognitive functioning. The study was limited by small sample size, which reduced statistical power. However, results indicated that women with lung disease exhibited fewer symptoms of distress and better cognitive functioning than men. In addition, dyspnea appears to be more relevant for distress among men than among women. Thus, sex

differences may be important to consider in evaluating and treating symptoms exhibited by patients with chronic lung disease.

Introduction

Pulmonary disease is debilitating and costly to both patients and society. Chronic obstructive pulmonary disease (COPD), the third leading cause of death (Centers for Disease Control and Prevention [CDC], 2013), is a progressive lung disease that impairs breathing and most frequently results from long-term smoking and exposure to other lung irritants. In 2000, COPD accounted for 8 million outpatient and physician office visits, 1.5 million emergency room visits, and 726,000 inpatient hospitalizations in the United States (Mannino & Braman, 2007; Mannino, Homa, Akinbami, Ford & Redd, 2002). Furthermore, COPD remains the only cause of respiratory mortality with increasing incidence (Katsura, Yamada, Wakabayashi & Kida, 2007). Idiopathic pulmonary fibrosis (IPF), another type of lung disease, results in the thickening of lung tissue, the origin of which is unknown. Approximately two thirds of IPF patients die within five years of diagnosis, resulting in roughly 40,000 deaths each year (Raghu, Weycker, Edelsberg, Bradford, & Oster, 2006). Compounding the large economic and clinical burden of pulmonary disease, co-morbid symptoms of depression occur frequently in patients with COPD and IPF. Among these patients, there is a strong association between depression and dyspnea, the subjective symptom of breathlessness (De Vries et al., 2001; Di Marco et al., 2006). Historically, research in pulmonary disease has focused on men due to the demographics of smoking. Yet, Maninno et al. (2002) reported a five-fold increase between 1971 and 2000 in the mortality rate among women due to COPD with the consequence that more women die from COPD than men (Han et al., 2007). However, in spite of these serious implications for women with lung disease, research on gender differences in COPD and IPF, particularly in the

experience of distress and cognitive functioning, remains limited.

Depression, a major public health problem, is highly prevalent, recurrent, and often chronic. Depression adversely impacts the progression and outcome of a variety of disabling conditions. The CDC (2013) estimates that one in 10 adults in the United States reports clinically significant levels of depression, with women reporting 1.5 to 3 times higher rates of depression than men (American Psychiatric Association [APA], 2013). Substantial health risks exist for both major depression and sub-threshold depressive symptoms. Untreated, depression can lead to decreased productivity, short-term disability, and increased work absence (CDC, 2011). A study of older men revealed an association between depressed mood at baseline and an increased risk for declines in muscle and grip strength over a three-year period, the latter of which predicts future functional limitations, declining overall health and increased disability (Rantanen et al., 2000; Rantanen, 2003). Furthermore, according to the World Health Organization (2012), depression is the primary contributor to disability worldwide. Additional research has linked depression with reduced effectiveness of rehabilitation in numerous conditions, including fractures, stroke, arthritis and chronic obstructive pulmonary disease (Katz, 1996).

In pulmonary disease, depression significantly impacts patients, healthcare and society. According to Stein et al. (2006), the comorbidity of lung disease and depression virtually doubles the likelihood of disability, work absence and healthcare utilization. In multiple studies of IPF, 23% of patients endorse significant levels of depression (De Vries, Kessels, & Drent, 2001; Ryerson et al., 2011) compared to 6.6% in the adult population in the United States (Substance Abuse and Mental Health Services Administration [SAMHSA], 2011). A recent investigation of interstitial lung disease, a lung-disease category which encompasses IPF, revealed that clinically

significant levels of depression at baseline were the most significant predictors of depression severity at the six month follow-up. Patients with clinically meaningful depression at initial evaluation experienced, at follow-up, a 34-fold increase in the odds of depression compared to those with no depression at baseline (Ryerson et al., 2012).

Patients with COPD exhibit higher rates of depression than patients with other chronic conditions, including cancer, arthritis, coronary heart disease, diabetes and IPF (Cao et al., 2006; Ng et al., 2007). Among patients with COPD, the prevalence of depression ranges from 42% to 71% (Maurer et al., 2008). In a sample of 18,588 participants over 50 years old, recruited from the 2004 United States' Health and Retirement Survey, depressive symptoms were 2.7 times more frequent in respondents with COPD than in those without COPD (Schane, Woodruff, Covinsky, & Walter, 2008). Furthermore, COPD patients who endorse depressive symptoms have a higher likelihood of pulmonary disease exacerbations, increased duration of hospital admissions and decreased social and physical functioning (Cao et al., 2006; Ng et al., 2007). After controlling for both disease severity and additional risk factors, a link between depressive symptoms and risk of mortality prevails for those hospitalized with COPD (Ng et al., 2007). However, there is no correlation between depression and hospital readmissions (Ng et al., 2007). It has been suggested that perhaps the feelings of helplessness and despair adversely affect patients' motivation and desire to seek medical help and, in doing so, reduce hospital readmission. As a result, lung disease patients may experience premature death (Ng et al., 2007).

Depression comorbid with COPD may have additional adverse effects on self-perceived quality of life and overall health status (Ng et al., 2007). Considering depression and anxiety together as independent determinants of health-related quality of life in patients with lung disease, emotional state explains over half of the variation in health-related quality of life

(Martínez Francés, Tordera, Fuster, Martínez Moragón & Torrero, 2008). Despite the association between depression and lung disease, as well as the resulting costs in dollars, healthcare utilization, suffering and, ultimately, lost years of life, there is a relative lack of attention to significant depressive symptoms in chronic lung disease patients in both primary and specialized care, resulting in a lack of treatment and an intensification of distress (Ng et al., 2007).

Additionally in COPD patients, dyspnea, the subjective awareness of shortness of breath, exacerbates the distress that accompanies lung disease. Although an association exists between depression and dyspnea, there is no correlation between dyspnea and pulmonary function in patients with lung disease (Grant, Heaton, McSweeny, Adams & Timms, 1982; Ryerson et al., 2001). Recently, Ryerson et al. (2001) documented that depression and functional status contribute to the severity of dyspnea among COPD patients. Additionally, in IPF patients, dyspnea correlates with depression and overall quality of life (De Vries et al., 2001; Ryerson et al., 2011). Furthermore, Di Marco et al. (2006) suggest that depression may potentiate dyspnea, accentuating the impact of psychological distress in lung disease. Unfortunately, dyspnea is frequently refractory to available therapies and rehabilitation and, thus, likely compounds the distress of pulmonary disease (Collard & Pantilat, 2008).

In patients with pulmonary disease, several studies have documented reduced cognitive functioning. Mildly to severely hypoxemic patients with COPD, those with an abnormally low level of blood oxygen, demonstrate cognitive difficulties in abstract reasoning, memory and coordination on simple motor tasks (Grant et al., 1982; Prigatano, Parsons, Levin, Wright & Hawryluk, 1983). Liesker et al. (2004) extended such findings to nonhypoxemic COPD patients. Compared to matched healthy controls, nonhypoxemic COPD patients experience significant cognitive dysfunction, especially on information-processing speed (Liesker et al., 2004). In other

studies, COPD patients demonstrate cognitive impairments in numerous domains including verbal learning, memory (Antonelli-Incalzi et al., 1997), fluid intelligence (Etnier & Berry, 2001), semantic fluency (Kozora & Make, 2000), reaction time and attention (Klein, Gauggel, Sachs & Pohl, 2010). Many factors, including the severity of disease and physical and psychological functioning, may influence cognitive capabilities in patients with chronic lung disease (Klein et al., 2010; Orth et al., 2006). While it is evident that deficits in cognitive functioning create additional mental health concerns and impact the progression of lung disease, it is uncertain whether gender differences in distress relate to gender differences in cognitive functioning.

Since women report more frequent depression and experience a higher mortality rate from COPD than men, research on sex differences in the experience of psychological accompaniments of chronic lung disease is warranted. Recently, however, Di Marco et al. (2006) observed gender differences in disease symptoms and severity in a sample of 202 COPD patients. Compared to men, women endorsed higher levels of anxiety and depression as well as higher self-reported levels of dyspnea for the same level of ventilatory impairment. Furthermore, the correlation between dyspnea and depression was greater in women than in men. According to Han et al. (2010), dyspnea diminishes physical quality-of-life for men while it exacerbates emotional distress for women, suggesting that lung disease may have differing effects on the psychological functioning of men and women. A study of COPD patients by Carrasco-Garrido et al. (2009) reveals that women experience more comorbidity and poorer quality of life. After adjusting for lung function and smoking burden, Martínez et al. (2008) found that women diagnosed with COPD reported greater dyspnea, depression and lower health status compared to men. Whether sex differences reflect comorbidities, such as depression and anxiety, or

physiologic differences, is unknown. In an international survey study, women were more likely to report severe dyspnea than men, despite documenting similar degrees of cough (Watson et al., 2004). Additionally, the sex difference in symptom reporting may reflect a response bias, specifically the tendency on the part of men to underreport depressive and psychological symptoms (Sigmon et al., 2005). However, further investigation of potential sex differences in lung disease patients will provide a more complete understanding of depression and dyspnea associated with pulmonary disease.

In addition to depression and dyspnea, the intensity of symptoms and health-related quality of life may differ by sex among patients with lung disease. In a study by de Torres et al. (2005), women reported greater dyspnea despite being significantly younger in age and engaging in less smoking behavior than men. In an additional clinical study, women scored lower than men with a similar degree of physiologic impairment in all domains of the St. George's Respiratory Questionnaire (SGRQ), an instrument designed to assess impact of obstructive airway disease on overall health, daily life, and perceived well-being (de Torres et al., 2006). In other words, despite comparable levels of physiologic impairment, women experienced more severe dyspnea and worse health status than men. Dales, Mehdizadeh, Aaron, Vandemheen and Clinch (2006) replicated the findings of de Torres et al. (2005), documenting that women with lung disease were more likely than men to report respiratory symptoms. The authors hypothesized that the gender difference may be a result of a difference in the severity or expression of disease.

Despite studies of patients with pulmonary disease documenting greater psychological distress among women than men, research on gender differences in lung disease, particularly in the experience of distress and cognitive function, remains limited. The lack of pulmonary

research involving gender differences is problematic, since death rates from COPD tripled for women between 1980 and 2000. Additionally, in 2000, for the first time, more women than men died of COPD, while population-based mortality rates remained higher among men (Mannino et al., 2002). The increasing prevalence of COPD and mortality among women may result in part from increased tobacco use, yet studies suggest that women, given the same level of tobacco exposure, may actually have a greater risk of developing smoking-induced impairment in pulmonary functioning, may experience more severe dyspnea, and may have poorer overall health (Han et al., 2007). Interestingly, research has also indicated that nonsmokers who develop COPD are more likely to be female than male (Birring et al., 2002). Regardless of the cause or causes, the increases in prevalence and death among women with COPD underscore the need for both clinical and public health interventions in the management and treatment of chronic lung disease.

Additionally, numerous studies have found evidence of gender bias in the diagnosis of COPD by primary care physicians. Chapman, Tashkin and Pye (2001) presented 200 primary care physicians in North America with two hypothetical cases of dyspnea and cough in smokers, differing only by sex. When asked for a diagnosis, physicians diagnosed COPD significantly more frequently for the male case than for the female. More recently, a similar study conducted by Miravitlles et al. (2006), confirmed these findings in a sample of physicians in Spain. However, displaying to the physicians results of spirometry, indications of atypical volume and/or flow of air, eliminated the gender bias in their diagnoses. Unfortunately, other research demonstrates that primary care physicians under-utilize spirometry (Kesten and Chapman, 1993). In addition, women receive fewer referrals for spirometry than men (Franks, Clancy, & Naumburg, 1995). Thus, women may be less likely than men to receive a diagnosis of COPD,

and consequently, the disease in women is more likely to remain untreated. Therefore, further research into sex differences in the psychological and cognitive functioning of chronic lung disease patients is needed.

Limited literature has investigated sex differences in psychological and cognitive functioning among patients with chronic lung disease. The few existing studies document significant sex differences. Therefore, this study will evaluate sex differences in symptoms of depression and dyspnea among patients with COPD and IPF, as well as the degree to which depression and dyspnea relate to cognitive function, in order to confirm findings from previous studies and extend the study of sex differences to the cognitive domain.

The present research assessed four hypotheses. Of these hypotheses, two replicate previous studies. Thus, it was hypothesized that (1) women will report more symptoms of both depression and dyspnea than men and (2) measures of depression and dyspnea will be more highly correlated among women than among men. Additionally, the remaining two hypotheses extended previous research to additional domains. Therefore, it was hypothesized that (3) there will be an inverse correlation between cognitive performance and levels of distress. Additionally, (4) when matched with men with the same level of ventilatory impairment, women will exhibit greater cognitive dysfunction than men.

Methods

Participants

This study utilized archival data collected between 2007 and 2008. The larger longitudinal study assessed depression, stress, cognitive function, and pro-inflammatory cytokine production among 31 men and women diagnosed with COPD or IPF (Emery, 2008). Recruitment occurred during patients' routine medical appointments in the outpatient pulmonary

clinics at The Ohio State University Medical Center. Participants with COPD met diagnostic criteria for COPD set forth by the American Thoracic Society (ATS) and the European Respiratory Society (ERS; Celli et al., 2004).

Participants in the study exhibited symptoms of sputum (mucus) production, cough and/or dyspnea on exertion. Potential subjects were excluded if they had expected survival of less than six months (as a result of lung disease or other medical conditions). Additionally, the study deemed female participants ineligible if they were pregnant or became pregnant during the study.

Procedures

At a routine clinic visit, participants completed informed consent, self-report measures of depression, anxiety, sleep, quality of life, and dyspnea, and tests of cognitive function were administered. The visit also incorporated standard pulmonary function tests.

Psychological/Behavioral Measures

Participants completed the following self-report measures.

Beck Anxiety Inventory (BAI). The Beck Anxiety Inventory measures both cognitive and physiological symptoms of anxiety through 21 self-report items. The measure has good internal consistency (Cronbach's $\alpha = .92$) and good test-retest reliability ($r = .71$; Beck et al., 1998). Additionally, the BAI appears more precise in discriminating anxiety from depression than other self-report anxiety scores (Beck et al., 1988).

Center for Epidemiological Studies Depression Scale (CESD). The CESD, a 20-item measure of depressive symptomatology, has excellent construct validity and acceptable test-retest reliability (Basco, Krebaum & Rush, 1997; Radloff, 1977). Additionally, the discriminant validity appears acceptable as it differentiates between depressed and non-depressed participants

in both community and clinical samples (Basco et al., 1997). Population norms for depressive symptomatology afford cutoffs for varying levels of depression (Basco et al., 1997).

University of California at San Diego Shortness of Breath Questionnaire (UCSD). The UCSD assesses the occurrence of shortness of breath (dyspnea) during 21 activities of daily living. Respondents rate the severity of dyspnea on a 6-point scale for each of 24 items (Eakin, Resnikoff, Prewitt, Ries, & Kaplan, 1998). Summary scores range from 0 to 120, with higher scores indicating greater perception of dyspnea. The UCSD has excellent internal consistency (Cronbach's $\alpha = 0.96$) and good validity, significantly correlating with a variety of measures including FEV_1 ($r = -0.45$, $p < 0.001$), the Quality of Well-Being Scale ($r = -0.37$, $p < 0.01$), CESD ($r = 0.42$, $p < 0.001$), 6 Minute Walk distance ($r = -0.67$, $p < 0.001$), perceived breathlessness ($r = 0.47$, $p < 0.001$), and muscle fatigue ($r = 0.28$, $p < 0.001$; Eakin et al., 1998).

St. George's Respiratory Questionnaire (SGRQ). The SGRQ assesses the impact of obstructive airway disease on patients' overall health, daily life, and perceived well-being (Jones, Quirk, Baveystock & Littlejohns, 1992). The disease-specific measure contains 50 items that yield three domain scores: Symptom (frequency and severity); Activity (activities that cause or are limited by breathlessness); and Impact (social functioning and psychological disturbances resulting from airway disease) as well as an overall score. Studies indicate the SGRQ to be a reliable and valid measure for use among patients with chronic lung disease (Jones et al., 1992; Tzanakis et al., 2005).

RAND 36-Item Short Form Health Survey (SF-36). The SF-36, a multi-purpose health survey, contains 36 questions. The survey assesses eight domains of health and well-being as well as provides physical and mental health summary measures and a health utility index. The present research focused exclusively on the physical and mental health summary measures. The

physical component score (PCS) more heavily reflects the four health concepts of physical functioning, bodily pain, role limitations due to physical health problems, and general health perceptions. The mental health component score (MCS) more heavily assesses the domains of social functioning, energy/fatigue, role limitations due to personal or emotional problems and, general mental health. The SF-36 serves as a generic measure since it does not target a given age, disease or treatment group.

Pittsburgh Sleep Quality Index. The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire of sleep quality as well as sleep disturbances (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989). The PSQI is comprised of 7 sub-scales including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction. These sub-scores can be summed to generate a global score. In differentiating between good and poor sleepers, the measure provides good diagnostic sensitivity and specificity. Research suggests that sleep quality influences both endocrine and immune function (Redwine, Hauger, Gillin, & Irwin, 2000; Vgontzas et al., 1999). Furthermore, in lung disease patients, an association exists between sleep quality and depression, anxiety, and dyspnea (Hill, Geist, Goldstein, & Lacasse, 2008).

Cognitive/Neuropsychological Measures

During the visit, participants completed a short battery of cognitive measures to examine areas of executive functioning that may be impaired in patients with chronic lung disease and which may be correlated with depression or dyspnea. Each cognitive measure is robust to practice effects, with alternate forms utilized at repeated assessments. Additionally, clinicians frequently employ such measures in evaluating patients' overall brain function and frontal lobe (executive) function in particular.

Controlled Oral Word Association Test (COWAT). The COWAT, part of the Halstead-Reitan battery, indicates a subject's organized verbal processing ability. The measure is comprised of two tasks, the letter task and the category task. For the letter task, respondents are given one minute to name as many words as possible that begin with a specific letter, excluding proper nouns and suffix variations. The test consists of three letters of increasing difficulty. Summing the number of acceptable words generated across the three levels yields an overall score, with a higher score indicating better performance. For the category task, respondents are given one minute to generate as many words as possible that fit within a specific category (e.g. animal). Summing the number of items generated that fit within the category yields an overall score for the measure, with a higher score indicating better performance. The COWAT has excellent test-retest reliability (r = .88; Spreen & Strauss, 1991).

Digit Symbol. The Digit Symbol subscale from the Wechsler Adult Intelligence Scale - Revised (WAIS-R), measures psychomotor speed, sequencing ability and implicit memory. Utilizing a coding key, participants write a series of symbols that correspond with specific printed digits as rapidly as possible. The test lasts for 90 seconds and the number of correct symbols drawn in this time period determines the score. The measure has high test-retest reliability (r =.88; Wechsler, 1981).

The Trail Making Test. The Trail Making Test assesses mental flexibility, attention, speed of processing and perceptual motor speed. The test is comprised of two independently timed trials. In Part A, the participant must connect 25 randomly dispersed circled numbers in numerical order, providing a widely accepted measure of sustained attention. Part B is similar to Part A, except that the numbers alternate with letters. Again, the participant connects the representations sequentially (i.e., 1 to A to 2 to B, etc.) as quickly as possible. Completion of this

task generates a well-respected assessment of executive function. Overall, the Trail Making Test has good test-retest reliability with coefficients ranging from .70 to .90 (Spreen & Strauss, 1991).

The Stroop Interference Test. The Stroop Interference Test assesses a respondent's ability to shift perceptual sets, attend selectively, and inhibit responses (Stroop, 1935). Additionally, the measure demonstrates adequate reliability (r = .73 – .86; Reitan, 1958). This study utilized Golden's (Golden, 1978) version of the Stroop Interference Task with three timed 45-second trials that utilize word, color, and interference lists. In the first trial, participants read aloud a list of color names, printed in black ink, as fast as possible. The second trial uses a list of color names printed in different color inks. Subjects read the listed words again, as quickly as possible. The last trial utilizes the same list of color words but, rather than reading the word, the participant must identify the color of ink of the color word, again as quickly as possible. This trial specifically requires the inhibition of semantic content, forcing participants to ignore the printed word, while focusing instead on the color of ink.

Pulmonary Function Testing

Standard pulmonary function testing equipment (Sensormedics 2450) indicated the flow rate of air as well as the volume of expired air following a maximum inspiration. Specifically, measurements included the forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1), measured in liters/second. Patients inhaled completely, and then exhaled into a mouthpiece using as much force as possible. FEV_1 indicates the volume of air expelled from the patient's lungs during the first second of expiration. FVC reflects the total amount of air the patient expired. Research has demonstrated that FEV_1 is one of the most sensitive measures of the severity of COPD. The FEV_1/FVC ratio, commonly used in diagnosis of COPD, provides an

indicator of the obstruction in pulmonary disease (Fletcher & Peto, 1997; Fletcher, Peto, Tinker, & Speizer, 1976). An FEV_1/FVC ratio of less than .70 is reflective of significant impairment in lung function. For each patient, comparing the FEV_1, FVC and the FEV_1/FVC ratio to published norms (according to age, sex and height) characterized the individual's severity of lung disease.

Six Minute Walk with Oximetery

Participants completed the six-minute walk test (6MWT) on a level, 30-meter linear track, in accordance with ATS guidelines. Following the provided instructions, participants walked as fast and as far as possible over the 6-minute interval, stopping to rest as needed. The data collector carried oxygen for those requiring it in order to complete the test. The 6MWT is a relatively simple and reliable assessment of functional exercise capacity (Stevens et al., 1999), utilized frequently in studies of lung disease as well as in clinical practice (Sciurbam et al., 2003). When compared to other maximum exercise tests, the 6MWT strongly correlates with severity of symptoms and quality of life (Stevens et al., 1999).

Data Analysis

The SAS (V9.03) statistical program for Windows was used for all data analyses. To evaluate demographic differences chi-square tests and one-way ANOVAs were conducted. To assess potential sex differences, one-way ANOVAs were conducted for all psychological, cognitive and pulmonary variables. Pearson product correlations evaluated relationships among measures of psychological wellbeing, cognitive functioning and pulmonary functioning.

Results

Preliminary Analyses

Preliminary analyses were conducted to evaluate diagnostic differences between the COPD and IPF groups on demographic characteristics, psychological well-being and cognitive

functioning. Additional analyses assessed sex differences on demographic characteristics, cognitive functioning, and pulmonary functioning.

Diagnostic Group Differences. As shown in Table 1, the COPD and IPF groups were generally similar with regard to demographic characteristics, although the COPD group was significantly younger, $F(1, 29) = 9.00$, $p = .006$.

As shown in Table 2, the COPD group exhibited poorer pulmonary functioning than the IPF group as reflected by FEV_1 and FEV_1/FVC. Additionally, the COPD group experienced significantly greater psychological distress than the IPF group. Specifically, the COPD group reported greater depression, greater dyspnea, greater anxiety, and poorer quality of life. The diagnostic groups did not differ on any measure of cognitive functioning.

Sex Differences. As indicated in Table 3, men and women did not differ in age, education, weight, or ethnicity.

To assess sex differences, independent sample ANOVAs were utilized for all measures of pulmonary functioning. As shown in Table 3, FVC and FEV_1 were significantly greater in men than women. Men walked significantly farther than women during the six-minute walk test, in line with expectations, given their typically larger body sizes and higher pulmonary function values.

For each neuropsychological test, ANOVA assessed sex differences. Despite the absence of sex differences in psychological distress, women performed better than men at baseline on both the Digit Symbol Test ($F(1, 29) = 5.88$, $p = .022$) and the Word t-score on the Stroop Interference Task ($F(1, 29) = 5.91$, $p = .022$), as shown in Table 4. There were no other sex differences in cognitive performance.

Hypothesis One

ANOVA was used to evaluate sex differences on all psychological measures. As shown in Table 4, men and women reported similar levels of distress, contrary to expectation.

The first hypothesis, that women will report more depression and greater dyspnea than men, was not supported; depression, $F(1, 28) = 0.41$, $p = .528$; dyspnea, $F(1, 28) = 1.44$, $p = 0.240$.

Hypothesis Two

A Pearson correlation between depression and dyspnea was used to evaluate the relationship of depression and dyspnea among women and among men. Contrary to predictions, depression and dyspnea were more highly correlated in men ($r(19) = .67$, $p < .001$) than in women ($r(7) = .49$, $p = .160$).

Hypothesis Three

For the third hypothesis, Pearson correlations assessed the degree of association between each cognitive measure and measures of depression, dyspnea, anxiety, sleep, and quality of life. Correlational analyses were conducted for the full sample as well as within the sample of men and within the sample of women.

As shown in Table 5, in the full sample, quality of life, as assessed by the SGRQ, was moderately correlated with the Stroop Word Raw Score, indicating that decreased quality of life was associated with poorer cognitive performance, $r(28) = -.42$, $p = .022$. Similarly, there was a trend for the physical component score (PCS) on the SF-36 to be positively correlated with Stroop Word Raw Score, such that poorer quality of life was associated with greater cognitive dysfunction, $r(28) = .36$, $p = .057$. These effects appear to be generated by the men in the sample. Among men, Pearson correlations revealed a relationship between decreased quality of life

(SGRQ) and Stroop Word Raw Score, $r(19) = -.48$, $p = .026$, and between physical quality of life (PCS) and Stroop Word Raw score, $r(17) = .45$, $p = .054$. In both correlations, worse quality of life was associated with poorer cognitive performance.

Additional relationships between quality of life and cognitive performance, not apparent in the full sample, were also observed among men. There was an association of decreased quality of life (SGRQ) with Trails A, $r(19) = -.42$, $p = .061$, and with the Digit Symbol subtest, $r(17) = .43$, $p = .068$, with both correlations reflecting a trend of greater cognitive impairment.

Among women, as shown in Table 5, increased dyspnea, as indicated by the UCSD measure, was associated with poorer Stroop Color Raw performance, $r(7) = -.68$, $p = .042$. Mental quality of life (MCS) was associated with Stroop Word t-scores such that worse quality of life correlated with decreased cognitive functioning, $r(7) = .70$, $p = .034$. There was a trend for increased depression, indicated by a higher CESD score, to be associated with poorer Stroop Word t-score performance, $r(7) = -.62$, $p = .076$.

Exploratory Analyses. To further expand on the third hypothesis, exploratory analyses were conducted with Pearson correlations to assess the relationship between each of the cognitive measures and the three measures of pulmonary functioning (FEV_1, FVC, and FEV_1/FVC) as well as the measure of exercise capacity (6MWT). Correlational analyses were conducted for the full sample as well as within the sample of men and within the sample of women.

Pulmonary functioning as assessed by FVC in the full sample was inversely correlated with Trails B such that decreased pulmonary function was associated with slower performance on Trails B, $r(27) = -.37$, $p = .043$.

Among men, lower functional capacity, assessed by the 6MWT, was associated with lower Stroop Color Raw scores, indicating that those who were less able to walk also had poorer cognitive functioning, $r(16) = .47$, $p = .050$.

Among women, lower pulmonary function, as assessed by FEV_1 and FVC, was correlated with poorer performance on the Stroop Color Raw Score, $r(7) = .70$, $p = .036$ and $r(7) = .64$, $p = .064$, respectively. Additionally, there was a significant relationship between lower FVC and lower Stroop Color Word Raw Score, $r(7) = .81$, $p = .008$. Each of these correlations suggests that within women, lower pulmonary function was associated with poorer cognitive performance.

Hypothesis Four

To assess the fourth hypothesis, 20 individuals were matched, 10 women and 10 men, on level of pulmonary impairment using FEV_1/FVC. For each cognitive measure, ANOVA was used to determine whether the scores of men significantly differed from those of women. Only the Digit Span subtest revealed a significant sex difference, $F(1,18) = 4.61$, $p = .046$. Contrary to the predictions, women performed significantly better than men on this measure.

Exploratory Analyses. Exploratory analyses were conducted to further examine this hypothesis. Using the same subset of 20 individuals, analyses determined whether men and women with the same level of ventilatory impairment differed in levels of psychological distress or other indicators of pulmonary functioning. There were no sex differences on any of the psychological measures, but men consistently indicated more distress than women across all psychological measures. On indicators of pulmonary functioning other than FEV_1/FVC, men and women only differed on the distance walked during the six minute walk test, $F(1,18) = 6.44$, $p = .021$. Men walked further than women, which is consistent with both the full sample and with

data from other samples (both healthy and chronically ill) indicating that men have higher levels of functional capacity than women.

Discussion

This study is one of few to investigate sex differences in psychological and cognitive functioning among patients with chronic lung disease.

Contrary to our first hypothesis, women did not report more symptoms of depression and dyspnea than men. Post hoc power analyses were conducted to assess whether the non-significant results were due to a lack of statistical power. The power analysis for the difference in mean depression scores between men and women yielded a power of .10 for an effect size of .27 while the difference in mean dyspnea scores between men and women yielded a power of .22 for an effect size of .49, both of which are considerably lower than the recommended power level of .80 (Cohen, 1992). Although the effect size for the difference in dyspnea is moderate to large, the power was limited likely due to the small sample of women (n = 10). This may explain not only the lack of significant findings but also the deviations of our results from those in the literature.

Depression and dyspnea were correlated both in men and in women. However, in contrast to earlier findings by Di Marco et al. (2006), the association was only significant in men, not in women. Although the correlation in women, $r(7) = .49$, did not reach significance, the magnitude of the correlation was moderate to large suggesting a substantial relationship between the variables. The absence of a significant relationship between depression and dyspnea in women may also be the result of an inadequate sample size and thus limited statistical power.

Despite the absence of gender differences in reported psychological distress, women performed better than men on the Digit Symbol task, a reliable measure of psychomotor speed. This effect was also observed in the analyses of the subset of male-female pairs matched on

pulmonary functioning. These results deviated from the hypothesis that women would exhibit greater cognitive dysfunction, associated with increased depression and dyspnea, than men with the same level of ventilatory impairment. However, within the matched subset, men indicated more psychological distress than women on every self-report measure, although the differences were not statistically significant. This elevated distress and increased endorsement of depression and anxiety among men is consistent with the slower psychomotor speed.

The finding that women reported fewer symptoms of distress than men with the same level of ventilatory impairment contrasts with findings of Di Marco et al. (2006). This deviation from the results of Di Marco et al. (2006) may be attributed to diagnostic differences within the samples studied. Whereas the findings of Di Marco et al. are based on a sample of COPD patients, the sample for this study included men and women with IPF as well as COPD. Although there was not a significant difference in the rates of diagnoses among men and women in our study, it is possible that our results differed from past results due to the fact that half of the sample was comprised of IPF patients. Additionally, preliminary analyses showed that the IPF patients in this study were significantly older and exhibited greater pulmonary functioning and less psychological distress than the COPD group.

Our preliminary analyses also indicated that women performed significantly better than men on both the Digit Symbol subtest and Word T-score on the Stroop, contrary to expectations. It is possible that the women in this study were exceptionally resilient and therefore performed better than expected, or that women with lung disease exhibit better cognitive functioning than men.

In evaluating the third hypothesis, we found that better quality of life was correlated with better cognitive performance in men and in women. This finding is consistent with data from

exercise intervention studies in patients with COPD (Emery et al., 1998; Kozora, Tran, & Make, 2002). Additionally in women, there was a significant relationship between greater dyspnea and poorer cognitive performance (Stroop Color Raw score), in line with predictions. These findings, in women and in men, lend support for our hypothesis that in COPD and IPF populations, cognitive performance and level of psychological distress are correlated.

Exploratory analyses, expanding upon the third hypothesis, indicated that in the full sample, poorer pulmonary functioning (FVC) was associated with poorer cognitive performance (Trails B). Likewise, in women, lower pulmonary functioning (FEV and FVC) was significantly linked to lower cognitive performance (multiple scores on the Stroop). Similarly, in men, lower exercise capacity (6MWT) was significantly correlated with poorer cognitive functioning (Stroop Color Raw score). These results reflect a relationship between lower functional and exercise capacity and decreased cognitive ability.

Limitations

The results of this study are limited by numerous factors. As previously mentioned, the small sample of women may have limited the statistical power of many of the analyses conducted. Additionally, this was a clinic-based study and therefore the patients included may not be representative of the entire population of COPD and IPF patients. Combining patients with differing pulmonary diagnoses may have obscured effects that would otherwise have been observed. Furthermore, the generalizability of our results is further hindered by the lack of ethnic diversity of our sample, as only one of the 31 participants identified with an ethnicity other than “Caucasian.”

Summary

In regards to sex differences in psychological distress and cognitive functioning, our predictions were only partially supported. The lack of sex differences on a number of measures may be attributable to our small sample size and the resulting limited statistical power. However, it may also be that, in the sample studied, the degree of impairment was such that it negated typically observed sex differences, such as those in depression and dyspnea. The women in this sample may have been exceptionally resilient and thus performed better than expected. If so, this may explain the sex differences that contrasted with past studies. However, it may also be that women with chronic lung disease indeed do exhibit fewer symptoms of distress and better cognitive functioning than men. Overall, dyspnea appears to be a more relevant indicator of distress in men than in women. Thus, sex differences may be important to consider in evaluating and treating symptoms exhibited by patients with chronic lung disease. Given the results of this study, future research examining sex differences in patients with pulmonary disease utilizing a larger sample size is warranted.

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Table 1
Characteristics of the Diagnostic Groups

	COPD (n = 16)		IPF (n = 15)		
Variable	*M*	*SD*	*M*	*SD*	*p*
Age	58.69	11.47	69.33	7.81	.006
Education	13.22	2.99	14.37	2.61	.266
Weight	179.94	51.02	200.07	42.73	.245
	n	%	*n*	%	
Gender					.901
Female	5	31.25	5	33.33	
Male	11	68.75	10	66.67	
Ethnicity					.325
Caucasian	15	93.75	15	100	
Black	1	3.23	0	0	

Table 2
Characteristics of the Diagnostic Groups

	COPD			IPF			
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Physiological							
FEV_1	16	1.40	.97	15	2.22	.62	.009
FVC	16	3.00	.97	15	2.78	.86	.512
FEV_1/FVC	16	.43	.18	15	.81	.06	< .001
6MWT	16	332.50	111.84	15	337.33	74.56	.889
Psychological							
CESD	16	15.72	10.22	15	7.83	5.72	.016
UCSD	16	47.40	18.61	15	27.26	15.23	.003
BAI	16	12.61	7.89	15	4.80	5.33	.004
PSQI	16	7.69	3.66	15	6.20	3.75	.273
SGRQ							
Overall	16	50.42	15.27	15	36.53	17.00	.022
Symptom	16	60.89	22.24	15	37.72	16.68	.005
Activity	16	69.19	20.35	15	55.35	20.35	.062
Impact	16	36.16	15.90	15	25.19	18.18	.061
SF-36							
PCS	14	34.37	8.38	15	42.57	8.72	.021
MCS	14	48.43	12.73	15	57.55	4.38	.014
Cognitive							
Trail Making							
Trails A	16	41.68	15.32	15	37.16	11.90	.369
Trails B	16	115.82	55.56	14	108.4	49.27	.690

Digit Span	16	41.75	7.33	15	41.93	8.18	.948
COWAT							
Letter	16	27.88	7.19	15	27.53	6.32	.890
Category	16	23.38	4.77	15	23.53	4.29	.924
Stroop							
Word Raw	16	79.19	12.28	15	85.07	10.37	.162
Word T	16	35.35	8.23	15	38.67	7.25	.231
Color Raw	15	59.33	8.26	13	61.15	10.52	.613
Color T	15	38.00	6.90	13	40.23	9.00	.465
Color Word Raw	15	30.87	8.09	13	31.54	6.96	.817
Color Word T	15	44.27	9.44	13	46.62	6.84	.464

Note. FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; 6MWT = six minute walk test; CESD = Center for Epidemiologic Studies Depression Scale; UCSD = University of California at San Diego Shortness of Breath Questionnaire; BAI = Beck Anxiety Inventory; SGRQ = St. George's Respiratory Questionnaire; PCS = Physical Component Summary; MCS = Mental Component Summary; COWAT = Controlled Oral Word Association Test

Table 3
Characteristics of Sex Groups

	Men (n = 21)		Women (n = 10)		
Variable	*M*	*SD*	*M*	*SD*	*P*
Age	63.48	12.37	64.60	8.41	.797
Education	13.90	3.07	13.00	2.37	.716
Weight	200.29	49.15	167.40	36.67	.071
	n	%	*n*	%	
Ethnicity					
Caucasian	1	93.75	15	100	
Black	1	3.23	0	0	
	M	SD	*M*	*SD*	*p*
Pulmonary Function					
FEV_1	2.07	.90	1.24	.66	.015
FVC	3.22	.86	2.19	.56	.002
FEV_1/FVC	.63	.20	.59	.29	.674
6MWT	360.38	100.45	281.20	48.70	.026

Note. FEV_1 = forced expiratory volume in 1 second; FVC = forced vital capacity; 6MWT = six minute walk test

Table 4
Psychological Well-Being and Cognitive Functioning

	Men			Women			
Measure	*n*	*M*	*SD*	*n*	*M*	*SD*	*p*
Psychological							
CESD	21	12.52	10.21	10	10.62	6.65	.528
BAI	21	8.75	8.64	10	9.00	5.89	.993
UCSD	21	34.71	20.50	10	44.30	17.15	.240
SF-36							
PCS	21	39.45	10.20	10	37.01	7.85	.613
MCS	19	51.42	10.77	10	54.62	8.98	.214
SGRQ							
Overall	21	43.98	20.10	10	43.11	10.30	.926
Symptom	21	51.48	24.19	10	45.91	19.87	.304
Activity	21	59.60	23.01	10	68.58	15.19	.246
Impact	21	32.25	20.06	10	27.69	11.36	.612
PSQI	21	6.76	3.53	9	7.33	4.50	.711
Cognitive							
Trail Making							
Trails A	21	38.22	13.91	10	42.17	13.69	.465
Trails B	20	115.41	52.12	10	105.75	53.83	.640
Digit Symbol	21	39.71	6.00	10	46.30	8.99	.022
COWAT							
Letter	21	26.24	7.36	10	30.80	3.52	.074
Category	21	23.48	4.55	10	23.40	4.55	.966
Stroop							

Word Raw	21	79.24	10.46	10	87.90	12.19	.050
Word T	21	34.71	6.69	10	41.50	8.41	.022
Color Raw	18	58.11	8.15	10	63.90	10.33	.114
Color T	18	37.22	7.30	10	42.30	8.17	.103
Color Word Raw	18	30.44	7.30	10	32.50	9.23	.494
Color Word T	18	44.50	8.40	10	46.90	8.23	.472

Note. CESD = Center for Epidemiologic Studies Depression Scale; UCSD = University of California at San Diego Shortness of Breath Questionnaire; BAI = Beck Anxiety Inventory; SGRQ = St. George's Respiratory Questionnaire; PCS = Physical Component Summary; MCS = Mental Component Summary; COWAT = Controlled Oral Word Association Test

Table 5
Intercorrelations of Psychological and Cognitive Variables

	BAI	CESD	SGRQ	UCSD	PSQI	MCS	PCS
Trails A	**-.19** -.38 *.51*	**-.16** -.33 *.50*	**-.27** -.42 *.41*	**-.10** -.31 *.46*	**-.12** -.20 *.02*	**-.07** .10 *-.58*	**-.05** .17 *-.53*
Trails B	**-.05** -.07 *.03*	**.08** .00 *.31*	**.21** .20 *.21*	**.11** .12 *.41*	**-.13** -.02 *-.49*	**.12** .33 *-.41*	**-.23** -.29 *-.09*
Word Raw	**-.28** -.23 *-.51*	**-.30** -.22 *-.49*	**-.42*** -.48* *-.32*	**-.31** -.36 *-.51*	**.07** .03 *.08*	**.20** -.03 *.51*	**.36** .45 *.38*
Word T	**-.19** -.12 *-.45*	**-.24** -.08 *-.62*	**-.19** -.22 *-.19*	**-.10** -.12 *-.37*	**.19** .16 *.20*	**.30** .03 *.70*	**.19** .25 *.24*
Color Raw	**.05** .23 *-.39*	**-.01** .21 *-.39*	**-.05** .08 *-.40*	**-.08** .07 *-.68**	**.29** .45 *.10*	**.06** -.27 *.36*	**-.01** -.06 *.22*
Color T	**.07** .24 *-.38*	**-.02** .20 *-.51*	**.03** .16 *-.34*	**.02** .16 *-.61*	**.31** .42 *.18*	**.17** -.11 *.51*	**-.19** -.17 *.13*
Color Word Raw	**.14** .33 *-.19*	**.08** .26 *-.24*	**.02** .22 *-.48*	**.04** .32 *-.48*	**.11** .21 *-.02*	**-.13** -.18 *-.17*	**-.19** -.21 *-.16*
Color Word T	**.12** .25 *-.20*	**.04** .20 *-.40*	**.11** .26 *-.42*	**.16** .35 *-.38*	**.12** .15 *.08*	**.06** .05 *-.02*	**-.29** -.29 *-.27*
COWAT							
Letter	**.11** .12 *.12*	**.10** .18 *-.06*	**.21** .25 *-.02*	**.21** .20 *-.15*	**.46*** .50* *.47*	**-.10** -.26 *.08*	**-.30** -.31 *-.19*
Category	**.13** .06 *.41*	**.03** -.01 *.23*	**.01** -.10 *.62*	**.05** -.09 *.41*	**.02** -.24 *.59*	**-.12** -.20 *.03*	**.00** .15 *-.46*
Digit Symbol	**.07** -.05 *-.16*	**-.23** -.11 *-.46*	**-.12** -.10 *-.27*	**-.14** -.23 *-.35*	**.21** -.01 *.45*	**.25** .03 *.41*	**.14** .43 *-.16*

Note. Bold text indicates full sample (n = 31). Normal text indicates men (n = 21). Italicized text indicates women (n = 9). BAI = Beck Anxiety Inventory; SGRQ = St. George's Respiratory Questionnaire; PCS = Physical Component Summary; MCS = Mental Component Summary; COWAT = Controlled Oral Word Association Test. * $p < .05$.

Beck Anxiety Inventory (BAI)

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by each symptom during the PAST WEEK, INCLUDING TODAY, by placing an X in the corresponding space in the column next to each symptom.

	NOT AT ALL	MILDLY It did not bother me too much.	MODERATELY It was very unpleasant but I could stand it.	SEVERELY I could barely stand it.
1. Numbness or tingling.	_____	_____	_____	_____
2. Feeling hot.	_____	_____	_____	_____
3. Wobbliness in legs.	_____	_____	_____	_____
4. Unable to relax.	_____	_____	_____	_____
5. Fear of the worst happening.	_____	_____	_____	_____
6. Dizzy or lightheaded.	_____	_____	_____	_____
7. Heart pounding or racing.	_____	_____	_____	_____
8. Unsteady.	_____	_____	_____	_____
9. Terrified.	_____	_____	_____	_____
10. Nervous.	_____	_____	_____	_____
11. Feelings of choking.	_____	_____	_____	_____
12. Hands trembling.	_____	_____	_____	_____
13. Shaky.	_____	_____	_____	_____
14. Fear of losing control.	_____	_____	_____	_____
15. Difficulty breathing.	_____	_____	_____	_____
16. Fear of dying.	_____	_____	_____	_____
17. Scared.	_____	_____	_____	_____
18. Indigestion or discomfort in abdomen.	_____	_____	_____	_____
19. Faint.	_____	_____	_____	_____
20. Face flushed.	_____	_____	_____	_____
21. Sweating (not due to heat).	_____	_____	_____	_____

Center for Epidemiological Studies Depression Scale (CESD)

Circle the number for each statement which best describes how often you felt or behaved this way – DURING THE PAST WEEK.

DURING THE PAST WEEK:	**Rarely or none of the time (less than 1 day)**	**Some or a little of the time (1-2 days)**	**Occasionally or a moderate amount of time (3-4 days)**	**Most of or all of the time (5-7 days)**
1. I was bothered by things that usually don't bother me.	**0**	**1**	**2**	**3**
2. I did not feel like eating; my appetite was poor.	**0**	**1**	**2**	**3**
3. I felt that I could not shake off the blues even with help from my family or friends.	**0**	**1**	**2**	**3**
4. I felt that I was just as good as other people.	**0**	**1**	**2**	**3**
5. I had trouble keeping my mind on what I was doing.	**0**	**1**	**2**	**3**
6. I felt depressed	**0**	**1**	**2**	**3**
7. I felt that everything I did was an effort.	**0**	**1**	**2**	**3**
8. I felt hopeful about the future.	**0**	**1**	**2**	**3**
9. I thought my life has been a failure.	**0**	**1**	**2**	**3**
10. I felt fearful.	**0**	**1**	**2**	**3**
11. My sleep was restless.	**0**	**1**	**2**	**3**
12. I was happy.	**0**	**1**	**2**	**3**
13. I talked less than usual	**0**	**1**	**2**	**3**
14. I felt lonely.	**0**	**1**	**2**	**3**
15. People were unfriendly.	**0**	**1**	**2**	**3**
16. I enjoyed life.	**0**	**1**	**2**	**3**
17. I had crying spells.	**0**	**1**	**2**	**3**
18. I felt sad.	**0**	**1**	**2**	**3**
19. I felt that people disliked me.	**0**	**1**	**2**	**3**
20. I could not get "going."	**0**	**1**	**2**	**3**

UCSD Shortness-of-Breath Questionnaire

Instructions: For each activity listed below, please rate your breathlessness on a scale between zero and five, where 0 is not at all breathless and 5 is maximally breathless or too breathless to do the activity. If the activity is one which you do not perform, please give your best estimate of breathlessness. Your response should be for an "average" day during the past week. ***Please respond to all items*.** Read the two examples below then begin the questionnaire.

Example 1:
How short of breath do you get while:

1. Brushing teeth…

0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

Harry has felt moderately short of breath during the past week while brushing his teeth and so circles a three for this activity.

Example 2:
How short of breath do you get while:

2. Mowing the lawn:

0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

Anne has never mowed the lawn before but estimates that she would have been too breathless to do this activity during the past week. She circles a five for this activity.

BEGIN QUESTIONNAIRE

When I do, or if I were to do, the following tasks, I would rate my breathlessness as:

1. At rest…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

2. Walking on a level at your own pace:
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

3. Walking on a level with others your age:
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

When I do, or if I were to do, the following tasks, I would rate my breathlessness as:

4. Walking up a hill…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

5. Walking up stairs…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

6. While eating…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

7. Standing up from a chair…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

8. Brushing teeth…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

9. Shaving and/or brushing hair…
   0----------1----------2----------3----------4----------5
   Not at all Severely Unable to do

10. Showering, bathing…
    0----------1----------2----------3----------4----------5
    Not at all Severely Unable to do

11. Dressing…
    0----------1----------2----------3----------4----------5
    Not at all Severely Unable to do

12. Picking up and straightening…
    0----------1----------2----------3----------4----------5
    Not at all Severely Unable to do

13. Doing dishes…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

When I do, or if I were to do, the following tasks, I would rate my breathlessness as:

14. Sweeping/vacuuming…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

15. Making bed…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

16. Shopping…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

17. Doing laundry…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

18. Washing car…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

19. Mowing lawn…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

20. Watering lawn…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

21. Sexual activities…
0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

How much do these limit you in your daily life?

22. Shortness of breath…

0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

How much do these limit you in your daily life?

23. Fear of "hurting myself" by overexerting…

0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

24. Fear of shortness of breath…

0----------1----------2----------3----------4----------5
Not at all Severely Unable to do

THE 36-ITEM SHORT-FORM HEALTH SURVEY (SF-36)

INSTRUCTIONS: This survey asks you for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities.

Answer every question by marking the answer as indicated. If you are unsure about how
to answer a question, please give the best answer that you can.

1. In general, would you say your health is:

(Circle one)

Excellent……1

Very Good…… 2

Good……3

Fair……4

Poor……...5

2. Compares to one year ago, how would you rate your health in general now?

(Circle one)

Much better now than one year ago…… 1

Somewhat better now than one year ago…… 2

About the same as one year ago…… 3

Somewhat worse now than one year ago……4

Much worse now than one year ago……..5

3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

ACTIVITIES	YES Limited A Lot	YES Limited A Little	NO, Not Limited At All
a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	**1**	**2**	**3**
b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	**1**	**2**	**3**
c. Lifting or carrying groceries	**1**	**2**	**3**
d. Climbing **several** flights of stairs	**1**	**2**	**3**
e. Climbing **one** flight of stairs	**1**	**2**	**3**
f. Bending, kneeling, or stooping	**1**	**2**	**3**
g. Walking **more than a mile**	**1**	**2**	**3**
h. Walking **several blocks**	**1**	**2**	**3**
i. Walking **one block**	**1**	**2**	**3**
j. Bathing or dressing yourself	**1**	**2**	**3**

4. During the past 4 weeks have you had any of the following health problems with your work or other regular activities as a result of your physical health?

	YES	**NO**
a. Cut down on the **amount of time** that you spent on work or other activities	**1**	**2**
b. Accomplished less than you would like	**1**	**2**
c. Were limited in the **kind** or work or other activities	**1**	**2**
d. Had **difficulty** performing the work or other activities (for example, it took extra effort)	**1**	**2**

5. During the **past 4 weeks**, have you had any of the following problems with your work or other daily as a result of any emotional problems (such as feeling depressed or anxious) ?

	YES	NO
a. Cut down on the **amount of time** you spent on work or activities	**1**	**2**
b. Accomplished less than you would like	**1**	**2**
c. Didn't do work or other activities as **carefully** as usual	**1**	**2**

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle one)

Not at all……1

Slightly……2

Moderately……3

Quite a bit……4

Extremely……5

7. How much bodily pain have you had in the past 4 weeks?

None……1

Very mild…… 2

Mild…… 3

Moderate……4

Severe……5

Very severe……6

8. During the past 4 weeks, how much did pain interefere with your normal work (including both work outside the home and housework)?

(Circle one)

Not at all……....1

A little bit……...2

Moderately…….3

Quite a bit……...4

Extremely……...5

9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give one answer that comes closest to the way that you have been feeling. How much of the time in the past 4 weeks:

(Circle one number on each line)

	All of the Time	Most of the Time	A Good bit of the Time	Some of the Time	Little of the Time	None of the Time
a. Did you feel full of pep?	1	2	3	4	5	6
b. Have you been a very Nervous person?	1	2	3	4	5	6
c. Have you felt so down In the dumps that Nothing could cheer You up?	1	2	3	4	5	6
d. Have you felt calm and Peaceful?	1	2	3	4	5	6
e. Did you have a lot of Energy?	1	2	3	4	5	6
f. Have you felt Downhearted and blue?	1	2	3	4	5	6
g. Did you feel worn out?	1	2	3	4	5	6
h. Have you been a happy person?	1	2	3	4	5	6
i. Did you feel tired?	1	2	3	4	5	6

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle one)

All of the time……1

Most of the time…….2

Some of the time……3

A little bit of the time……4

None of the time…….5

11. How TRUE or FALSE is each of the following statements for you?

(circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get sick a Little easier than Other people	**1**	**2**	**3**	**4**	**5**
b. I am as healthy as Anybody I know	**1**	**2**	**3**	**4**	**5**
c. I expect my health to Get worse	**1**	**2**	**3**	**4**	**5**
d. My health is Excellent	**1**	**2**	**3**	**4**	**5**

St. George's Respiratory Questionnaire
PART 1

Questions about how much chest problem you have had over the past 4 weeks.

Please checkmark (✓) *one box for each questio*n:

		Most days a week	Several days a week	A few days a month	Only with chest infections	Not at all
1.	Over the past 4 weeks, I have coughed:	☐	☐	☐	☐	☐
2.	Over the past 4 weeks, I have brought up phlegm (sputum):	☐	☐	☐	☐	☐
3.	Over the past 4 weeks, I have had shortness of breath:	☐	☐	☐	☐	☐
4.	Over the past 4 weeks, I have had attacks of wheezing:	☐	☐	☐	☐	☐

5. During the past 4 weeks, how many severe or very unpleasant attacks of chest problem have you had?

Please checkmark (✓) *one box only*:

- more than 3 attacks ☐
- 3 attacks ☐
- 2 attacks ☐
- 1 attack ☐
- no attacks ☐

6. How long did the worst attack of chest problem last:
(Go to question 7 if you had no severe attacks)

Please checkmark (✓) *one box only*:

- a week or more ☐
- 3 days or more ☐
- 1 or 2 days ☐
- Less than a day ☐

7. Over the past 4 weeks, in an average week, how many good days (with little chest problem) have you had:

Please checkmark (✓) *one box only*:

- No good days ☐
- 1 or 2 good days ☐
- 3 or 4 good days ☐
- Nearly every day was good ☐
- Every day was good ☐

8. If you have a wheeze, is it worse in the morning:

Please checkmark (✓) *one box only*:

No ☐
Yes ☐

St. George's Respiratory Questionnaire
PART 2

Section 1

How would you describe your chest condition?

Please checkmark (✓) *one box only*:

The most important problem I have ☐
Causes me quite a lot of problems ☐
Causes me a few problems ☐
Causes me no problem ☐

If you have ever had paid employment.

Please checkmark (✓) *one box only*:

My chest problem made me stop work altogether ☐
My chest problem interferes with my work or made me change my work ☐
My chest problem does not affect my work ☐

Section 2

Questions about what activities usually make you feel breathless <u>these days</u>.

For ***each item***, please checkmark (✓) the box as it applies to you ***these days***:

	True	False
Sitting or lying still	☐	☐
Getting washed or dressed	☐	☐
Walking around at home	☐	☐
Walking outside on the level	☐	☐
Climbing up a flight of stairs	☐	☐
Climbing hills	☐	☐
Playing sports or games	☐	☐

Section 3

Some more questions about your cough and breathlessness <u>these days</u>.

For ***each item***, please checkmark (✓) the box as it applies to you ***these days****:*

	True	False
My cough hurts	☐	☐
My cough makes me tired	☐	☐
I am breathless when I talk	☐	☐

I am breathless when I bend over	☐	☐
My cough or breathing disturbs my sleep	☐	☐
I get exhausted easily	☐	☐

Section 4

Questions about other effects that your chest problem may have on you <u>these days</u>.

	For ***each item***, please checkmark (✓) the box as it applies to you ***these days***:	
	True	False
My cough or breathing is embarrassing in public	☐	☐
My chest problem is a nuisance to my family, friends or neighbours	☐	☐
I get afraid or panic when I cannot get my breath	☐	☐
I feel that I am not in control of my chest problem	☐	☐
I do not expect my chest to get any better	☐	☐
I have become frail or an invalid because of my chest	☐	☐
Exercise is not safe for me	☐	☐
Everything seems too much of an effort	☐	☐

Section 5

Questions about your medication. If you are taking no medication go straight to Section 6.

	For ***each item***, please checkmark (✓) the box as it applies to you ***these days***:	
	True	False
My medication does not help me very much	☐	☐
I get embarrassed using my medication in public	☐	☐
I have unpleasant side effects from my medication	☐	☐
My medication interferes with my life a lot	☐	☐

Section 6

These are questions about how your activities might be affected by your breathing.

	For ***each item***, please checkmark (✓) the box as it applies to you ***because of your breathing***:	
	True	False
I take a long time to get washed or dressed	☐	☐
I cannot take a bath or shower, or I take a long time	☐	☐
I walk slower than other people, or I stop for rests	☐	☐
Jobs such as housework take a long time, or I have to stop for rests	☐	☐
If I walk up one flight of stairs, I have to go slowly or stop	☐	☐

If I hurry or walk fast, I have to stop or slow down	☐	☐
My breathing makes it difficult to do things such as climbing up hills, carrying things up stairs, light gardening such as weeding, dancing, playing bowls or golf	☐	☐
My breathing makes it difficult to do things such as carrying heavy loads,digging the garden or shovelling snow, jogging or walking at 8 kilometres per hour, playing tennis or swimming	☐	☐
My breathing makes it difficult to do things such as very heavy manual work, running, cycling, swimming fast or playing competitive sports	☐	☐

Section 7

We would like to know how your chest problem <u>usually</u> affects your daily life.

For ***each item***, please checkmark (✓) the box as it applies to you ***because of your chest problem***:

	True	False
I cannot play sports or games	☐	☐
I cannot go out for entertainment or recreation	☐	☐
I cannot go out of the house to do the groceries	☐	☐
I cannot do housework	☐	☐
I cannot move far from my bed or chair	☐	☐

Here is a list of other activities that your chest problem may prevent you doing (you do not have to checkmark these, they are just to remind you of ways in which your breathlessness may affect you):

Going for walks or walking the dog
Doing things at home or in the garden
Sexual intercourse
Going out to church or place of entertainment
Going out in bad weather or into smoky rooms
Visiting family or friends or playing with children

Please write in any other important activities that your chest problem may stop you doing:

……

……

Now, would you checkmark the box (one only) which you think best describes how your chest affects you:

It does not stop me doing anything I would like to do ☐

It stops me doing one or two things I would like to do ☐

It stops me doing most of the things I would like to do ☐

It stops me doing everything I would like to do ☐

Thank you for filling in this questionnaire. Before you finish, would you check to see that you have answered all the questions.

PITTSBURGH SLEEP QUALITY INDEX

INSTRUCTIONS:
The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you . . .

a) Cannot get to sleep within 30 minutes

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

b) Wake up in the middle of the night or early morning

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

c) Have to get up to use the bathroom

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

d) Cannot breathe comfortably

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

e) Cough or snore loudly

	Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
f)	Feel too cold			
	Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
g)	Feel too hot			
	Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
h)	Had bad dreams			
	Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____
i)	Have pain			
	Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

j) Other reasons, please describe _____

_____

How often during the past month have you had trouble sleeping because of this?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____

Only a very slight problem _____

Somewhat of a problem _____

A very big problem _____

10. Do you have a bed partner or room mate?

No bed partner or room mate _____

Partner/room mate in other room _____

Partner in same room, but not same bed _____

Partner in same bed _____

11. If you have a room mate or bed partner, ask him/her how often in the past month you have had . . .

a) Loud snoring			
Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

b) Long pauses between breaths while asleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

c) Legs twitching or jerking while you sleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

d) Episodes of disorientation or confusion during sleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

e) Other restlessness while you sleep, please describe _____
_____
_____

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____